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COMPARATIVE VERIFICATION OF LOCAL AND GUIDANCE SURFACE WIND FORECASTS--NO. 2

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by

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We have verified TDL's automated forecasts of surface wind for the months April through September 1974. These forecasts are based on the warm season (April-September) regression equations described in National Weather Service (NWS) Technical Procedures Bulletin No. 86 (NWS, 1973a).

We conducted this verification study in conjunction with the NWS combined aviation/public weather verification system (NWS, 1973b). Scores for our objective guidance forecasts are presented here along with corresponding scores for official local forecasts prepared at Weather Service Forecast Offices (WSFO's). Table 1 in TDL Office Note 73-12 (Carter et.al., 1974) shows the 92 stations used.[1] The Technical Procedures Branch of the Office of Meteorology and Oceanography furnished us with the local forecasts.

Since the local forecasts are recorded as calm if the wind speed is expected to be less than 8 knots, the comparison is presented in two ways. For all those cases where both the local and guidance forecasts were at least 8 knots, the mean absolute error (MAE) of direction and speed, and the bias (mean forecast minus mean observed) of speed were computed. Cases where both the local and guidance forecasts were at least 8 knots and the observed wind was calm were eliminated from the MAE calculations for wind direction. Also, for all cases where local and guidance forecasts were available, skill score, percent correct, and bias by category were computed from wind speed contingency tables which have categories of less than 8, 8-12, 13-17, 18-22, and greater than 22 knots.

Tables 1-5 show verification scores for the 6-month period April through September 1974. Three projections are shown. For the guidance forecasts, which are made from 0000 GMT data, these are 18, 30, and 42 hours, and are so listed in the tables. However, the local forecasts are not released until 1000 GMT, so about 9 hours later data are available for their preparation. It should be noted that the objective speed forecasts were enhanced by the method described in NWS Technical Procedures Bulletin No. 102 (NWS 1973c).

Statistics for all 92 stations combined are shown in Table 1. The MAE scores for both direction and speed, as well as the skill scores and percents correct, indicate that the guidance forecasts were better than the local forecasts for all three projections. The magnitude of this advantage does not vary much with projection. The guidance forecasts are nearly unbiased in the mean; however, the individual biases by category from the contingency tables reveal a tendency to underforecast the higher wind speeds. The local forecasts are much better in this regard.

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[1]Tucumcari, New Mexico replaced Farmington, New Mexico in this current study.

Tables 2-5 show similar results for the NWS Eastern, Southern, Central, and Western Regions, respectively. Category two (8-12 knots) is overforecast by the objective system for all three projections in each region, while the frequencies of occurrence of categories four (18-22 knots) and five (greater than 22 knots) are underforecast.

For each Region the mean absolute errors, skill scores, and percents correct for the summertime objective guidance forecasts are better than those for the local forecasts from the WSFO's. This conclusion is the same as that reached for wintertime forecasts (Carter, et. al., 1974). However, the objecti forecasts have undesirable bias characteristics. We plan to improve this aspect of the forecasts with the implementation of new summer equations on April 1, 1975.

ACKNOWLEDGEMENT

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REFERENCES

Carter, G. M., H. R. Glahn, and G. W. Hollenbaugh, "Comparative Verification of Local and Guidance Surface Wind Forecasts--No. 1," TDL Office Note, No. 74-12 (Revised), Techniques Development Laboratory, Silver Spring, Md., 1974, 8 pp.

NWS, "Surface Wind Forecasts Based on Model Output Statistics (MOS)--No. 1," Technical Procedures Bulletin, No. 86, 1973a, 11 pp.

NWS, "Combined Aviation/Public Weather Forecast Verification," National Weather Service Operations Manual, Chapter C-73, 1973b, 14 pp.

NWS, "Surface Wind Forecasts Based on Model Output Statistics (MOS)--No. 4," Technical Procedures Bulletin, No. 102, 1973c, 4 pp.

Table 1. Comparative verification scores for NWS official local and TDL guidance surface wind forecasts at 92 stations across the United States during April through September 1974.

FCST. PROJ. (HRS)	TYPE OF FCST.	DIRECTION		SPEED (KTS.)												
		MEAN ABS. ERROR (DEG.)	NO. OF CASES	MEAN ABS. ERROR	MEAN FCST.	MEAN OBS.	BIAS	NO. OF CASES	CONTINGENCY TABLE							
									SKILL SCORE	PERCENT FCST. CORRECT	BIAS BY CATEGORY					NO. OF CASES
											CAT1	CAT2	CAT3	CAT4	CAT5	
18	GUIDANCE	34	8134	2.9	11.2	11.2	.0	8187	.28	53	.76	1.40	.76	.47	.28	14031
	LOCALS	37		3.3	12.3	11.2	+1.1		.24	49	.82	1.16	1.09	.83	.48	
30	GUIDANCE	36	3188	3.3	10.0	9.9	+ .1	3250	.32	68	1.02	1.18	.43	.08	.00	13907
	LOCALS	40		3.9	11.4	9.9	+1.5		.24	61	.89	1.33	.98	.69	.30	
42	GUIDANCE	44	8426	3.2	10.8	10.8	.0	8502	.22	50	.65	1.57	.70	.24	.03	14020
	LOCALS	50		3.7	11.8	10.8	+1.0		.17	46	.77	1.28	1.04	.49	.16	

Table 2. Comparative verification scores for NWS official local and TDL guidance surface wind forecasts at 24 stations in the Eastern Region of the NWS during April through September 1974.

FCST. PROJ. (HRS)	TYPE OF FCST.	DIRECTION		SPEED (KTS.)												
		MEAN ABS. ERROR (DEG.)	NO. OF CASES	MEAN ABS. ERROR	MEAN FCST.	MEAN OBS.	BIAS	NO. OF CASES	CONTINGENCY TABLE							
									SKILL SCORE	PERCENT FCST. CORRECT	BIAS BY CATEGORY					NO. OF CASES
											CAT1	CAT2	CAT3	CAT4	CAT5	
18	GUIDANCE	35	2408	2.7	11.2	11.0	+ .2	2414	.26	53	.66	1.44	.69	.54	.44	3682
	LOCALS	37		3.1	12.0	11.0	+1.0		.24	51	.78	1.20	.98	.73	.68	
30	GUIDANCE	37	691	3.0	9.7	9.4	+ .3	704	.33	73	1.04	1.07	.32	.04	.00	3656
	LOCALS	39		3.9	11.4	9.4	+2.0		.25	64	.85	1.48	1.09	1.09	.20	
42	GUIDANCE	45	2480	3.0	10.7	10.6	+ .1	2492	.18	50	.51	1.60	.62	.31	.00	3678
	LOCALS	48		3.4	11.6	10.6	+1.0		.15	46	.74	1.27	.94	.52	.29	

Table 3. Comparative verification scores for NWS official local and TDL guidance surface wind forecasts at 24 stations in the Southern Region of the NWS during April through September 1974.

FCST. PROJ. (HRS.)	TYPE OF FCST.	DIRECTION		SPEED (KTS.)												
		MEAN ABS. ERROR (DEG.)	NO. OF CASES	MEAN ABS. ERROR	MEAN FCST.	MEAN OBS.	BIAS	NO. OF CASES	CONTINGENCY TABLE							
									SKILL SCORE	PERCENT FCST. CORRECT	BIAS BY CATEGORY					NO. OF CASES
											CAT1	CAT2	CAT3	CAT4	CAT5	
18	GUIDANCE	33	2002	2.7	10.9	10.5	+ .4	2015	.30	56	.76	1.37	.81	.51	.47	3599
	LOCALS	36		3.3	12.3	10.5	+1.8		.21	48	.68	1.25	1.26	1.20	1.35	
30	GUIDANCE	32	694	3.3	10.4	10.6	- .2	705	.38	73	1.00	1.23	.53	.09	.00	3561
	LOCALS	35		3.7	11.6	10.6	+1.0		.31	68	.93	1.31	.88	.82	.25	
42	GUIDANCE	43	2042	2.9	10.5	10.2	+ .3	2061	.25	53	.70	1.52	.73	.23	.00	3590
	LOCALS	48		3.7	12.0	10.2	+1.8		.16	45	.62	1.37	1.25	.88	.38	

Table 4. Comparative verification scores for NWS official local and TDL guidance surface wind forecasts 28 stations in the Central Region of the NWS during April through September 1974.

FCST. PROJ. (HRS)	TYPE OF FCST.	DIRECTION		SPEED (KTS.)												
		MEAN ABS. ERROR (DEG.)	NO. OF CASES	MEAN ABS. ERROR	MEAN FCST.	MEAN OBS.	BIAS	NO. OF CASES	CONTINGENCY TABLE							
									SKILL SCORE	PERCENT FCST. CORRECT	BIAS BY CATEGORY					NO. OF CASES
											CAT1	CAT2	CAT3	CAT4	CAT5	
18	GUIDANCE	34	3005	3.1	11.6	11.9	- .3	3036	.23	49	.76	1.37	.83	.48	.22	4282
	LOCALS	38		3.5	12.7	11.9	+ .8		.20	45	.70	1.19	1.16	.75	.29	
30	GUIDANCE	38	1350	3.4	10.2	9.9	+ .3	1381	.27	61	1.01	1.22	.49	.13	.00	4221
	LOCALS	43		4.0	11.4	9.9	+1.5		.19	52	.76	1.53	.98	.65	.44	
42	GUIDANCE	45	3217	3.5	11.1	11.4	- .3	3261	.15	45	.50	1.62	.81	.24	.04	4283
	LOCALS	52		3.9	12.0	11.4	+ .6		.12	41	.60	1.36	1.14	.33	.09	

Table 5. Comparative verification scores for NWS official local and TDL guidance surface wind forecasts at 16 stations in the Western Region of the NWS during April through September 1974.

FCST. PROJ. (HRS)	TYPE OF FCST.	DIRECTION		SPEED (KTS.)												
		MEAN ABS. ERROR (DEG.)	NO. OF CASES	MEAN ABS. ERROR	MEAN FCST.	MEAN OBS.	BIAS	NO. OF CASES	CONTINGENCY TABLE							
									SKILL SCORE	PERCENT FCST. CORRECT	BIAS BY CATEGORY					NO. OF CASES
											CAT1	CAT2	CAT3	CAT4	CAT5	
18	GUIDANCE	34	719	3.2	10.7	11.1	- .4	722	.25	56	.86	1.44	.59	.16	.17	2468
	LOCALS	36		3.5	12.1	11.1	+1.0		.24	56	1.13	.87	.83	.67	.39	
30	GUIDANCE	35	453	3.1	9.7	9.6	+ .1	460	.26	65	1.02	1.19	.23	.00	.00	2469
	LOCALS	38		3.8	11.3	9.6	+ 1.7		.19	62	1.09	.83	.98	.43	.22	
42	GUIDANCE	43	687	3.5	10.3	10.6	- .3	688	.24	55	.86	1.51	.46	.17	.06	2469
	LOCALS	47		3.8	11.3	10.6	+ .7		.17	54	1.14	.97	.57	.36	.19	